Apollo Solar

Battery- based PV Electronics

Simpleified for

Faster, Less Costly Installations

2011

Apollo Solar, Inc
Bethel, CT USA

Iian tech Co., Ltd.
Korea

We Asked what you needed……

Installers asked us for

With these priorities understood, we completed development of a complete line of products for the battery-based installer

Introducing the Four New Products That Installers Asked For

1. True sine Wave, Stackable, Split Phase, Battery Based Inverter/Chargers- The Apollo Solar TSW

2. 200 Volt input Charge Controller- The Apollo T80HV

3. Internet Remote Monitoring for every product/application-- The Apollo Internet Gateway

4. Low -Cost circuit breaker enclosure that makes for quicker and smoother installations- The Apollo ISM Module

True Sine wave Inverter/Chargers

* Pure Sine wave (순수 정현 사인파)
* 120VAC *and* 230VAC, 240VAC *Split Phase* 60Hz in one SKU
* 3600 watts for 48V systems
* 3200 watts for 24V systems
* 2200 watts for 12V systems
* *200% Surge capability for 10 seconds*
* *Parallel Stacking* for more power
* *4 Stage* battery Charging with *Power factor Correction*
* Data communications *Gateway* available for *wireless local* and *internet monitoring*

Compare features and Benefits-1

Apollo TSW3224 and Outback VFX3524 compare

* TSW is Split Phase 120/240VAC and can start motors and well pumps with one Inverter instead of two - VFX is not Split Phase
* Cost:
  - $2295 for the Apollo TSW3224 120/240VAC
  - $2569 for the Outback VFX3524 (120VAC only)
  - $2679 for the Outback VFX3024E (240VAC only)
* Surge Capability:
  - TSW -- Full 6400VA for 10sec. start a 3hp motor. With 5000VA for 5 seconds, VFX3524 will not start the same motor.
* Inverter data Display: TSW Display included at no extra cost. VFX Mate is $295 extra.
* Battery Charger: TSW is 100Amps, power factor corrected to .99.
  - VFX is 85 Amps, Power factor Correction ?
* Wireless and Internet remote Monitoring: Available only from Apollo
* Warranty: TSW 5 Years Standard--VFX 2 Years Standard

Compare features and Benefits-2

Apollo TSW3224 and Magnum MS4024AE compare

* Parallel Stacking - wire up to 10 TSW in parallel for 32KW
* Cost (List prices)

  $2295 for the Apollo TSW3224

  $2599 for the Magnum MS4924AE
* Surge Capability:

  TSW is Full 6400VA for 10 seconds - Enough to start a 3hp motor with ease.

  MS4024AE is 5800watts for 5 seconds.
* TSW Display Included - See what the inverter is doing without buying a separate display. The magnum ME-RC is $229 extra.

* Better Wiring Boxes - Stackable ISM or Enclosed SPC from Apollo.
* Wireless and Internet Remote Monitoring: Available only from Apollo.
* Warranty: TSW 5 Years Standard - Magnum 2 Years Standard.

Compare features and Benefits-3

Apollo TSW3224 and Xantrex XW copare.

* Cost (List price)

  $2295 for the Apollo TSW3224

  $3250 for the Xantrex XW4024

* Smaller Size

  TSW is 21" tall * 8" wide * 7" deep

  XW is 30" tall * 16" wide * 9" deep

* Lighter Weight

  TSW is 50 lbs.

  XW is 150 lbs.!!

* Smaller and lower cost wiring box

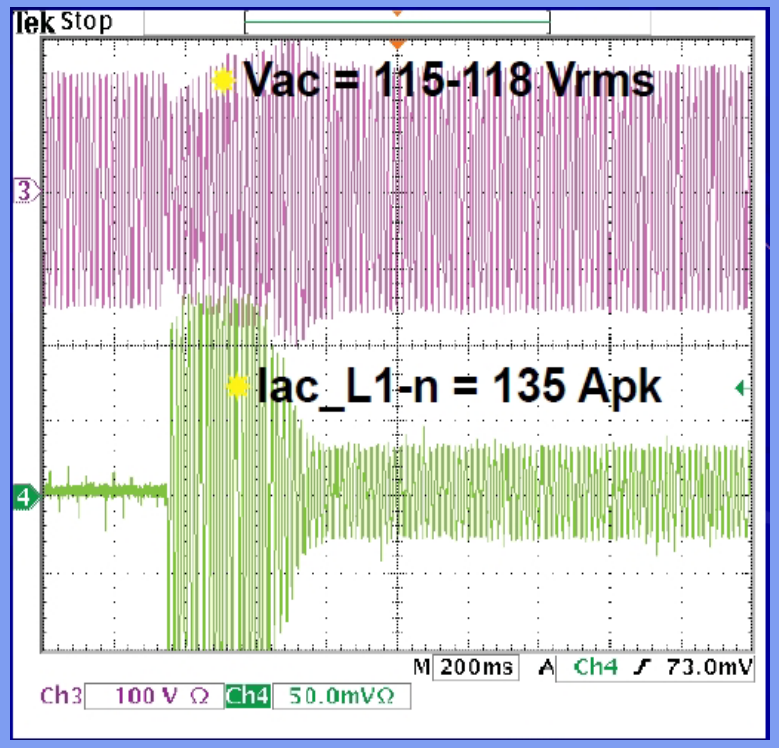
  Apollo ISM is $799, XW Distribution Box is $1500

* Wireless and Internet remote Monitoring: Available only from Apollo

Apollo TSW

Best in Class Surge for Motor Starting

Starting motors with
inverters is not easy-



The TSW provides

* 200% of continuous power for 10 seconds,
* 150% for 30 seconds,
* 120% for 30 minutes.

The Apollo Solar T80HV

The only 200 volt Charge Controller on the Market

* 80 Amps into batteries at up to 45℃(113°F) ambient temperature
* 200 Volt Open circuit Input
* All the T80 features and benefits
* 250V circuit Breakers available

* Use the new samsung PV modules or a string of 7 LG, Solar-tech.
* Fits into the Apollo SPC and with the ISM enclosures

Apollo Communications Gateway

Provides easy plug-and-play connectivity to Apollo Products using Ethernet. Local access using Apollo System Manager software or using the Internet.

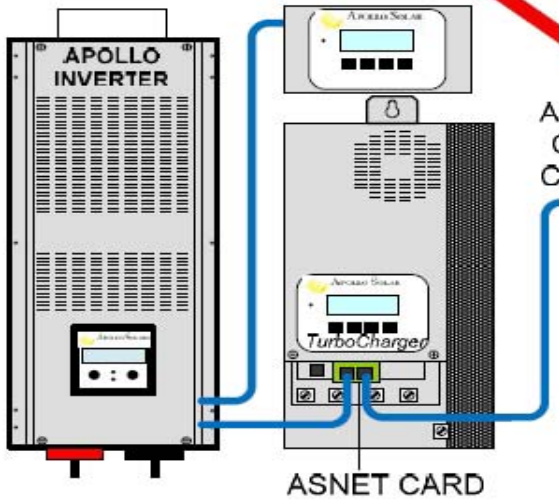
Access any Apollo Solar installation from any computer via the Internet

Apollo Solar Remote Data Monitoring

- Apollo Communication Gateway ACG-1

- Apollo Cellular Modem ACM-1

APOLLO SOLAR - REMOTE DATA MONITORING



ASNET CAT5 CABLE

ACG-1
APOLLO COMMUNICATION GATEWAY

The Apollo Communication Gateway reads the data from each Apollo Solar device on the ASNET. The data are parsed, stored and sent out the Ethernet port at programmed intervals.

ETHERNET CAT5 CABLE

ACM-1
APOLLO CELLULAR MODEM

GSM CELLULAR ANTENNA

-- OR --

To a local Internet Router if available.

The data from the ACG-1 may be sent out via a local Internet Router – or – to the Internet via ACM-1 Cellular Modem.

ROUTER

INTERNET TO APOLLO SOLAR SERVER

Apollo Solar Communications and Systems-Monitoring Superiority

* Remote telemetry confirms full system functionality quickly and easily before leaving the installation site.

* Remote Systems- monitoring and data Logging to local network and/or to the Internet.

* CAT5 Cable (300 meters) to Remote display

* Cellular Modem (GSM) option

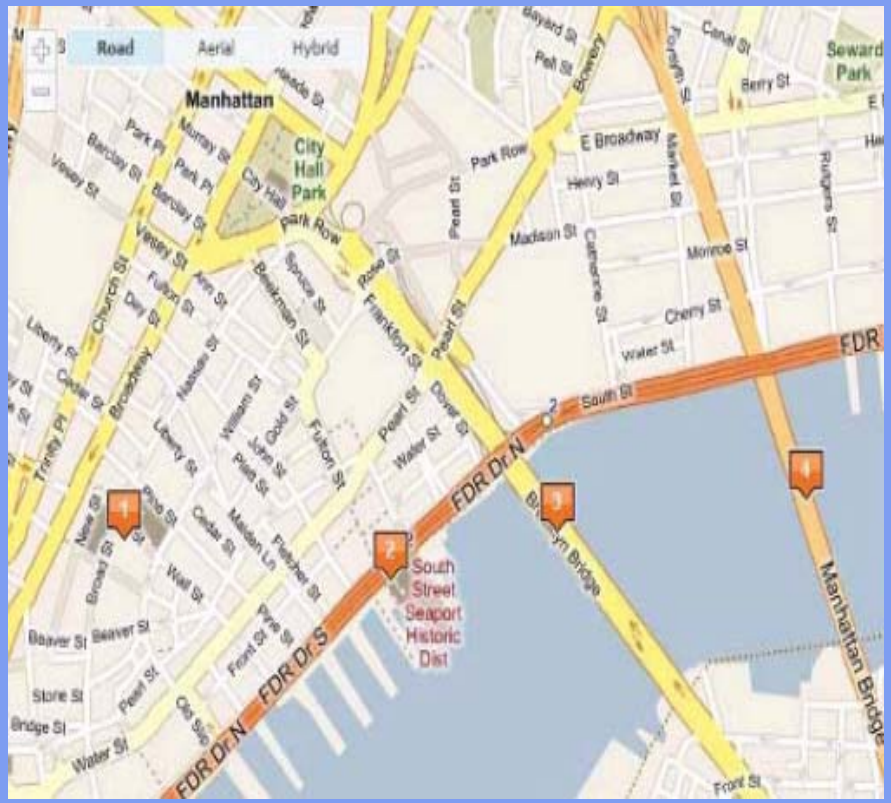
* Alarm option on critical parameters

Internet Monitoring

* End users can monitor their own installations.

* The Installer can monitor all his systems for preventative maintenance.

* The customer can have confidence that systems perform as expected.



NEW - Apollo Solar
Inverter Switchgear Module

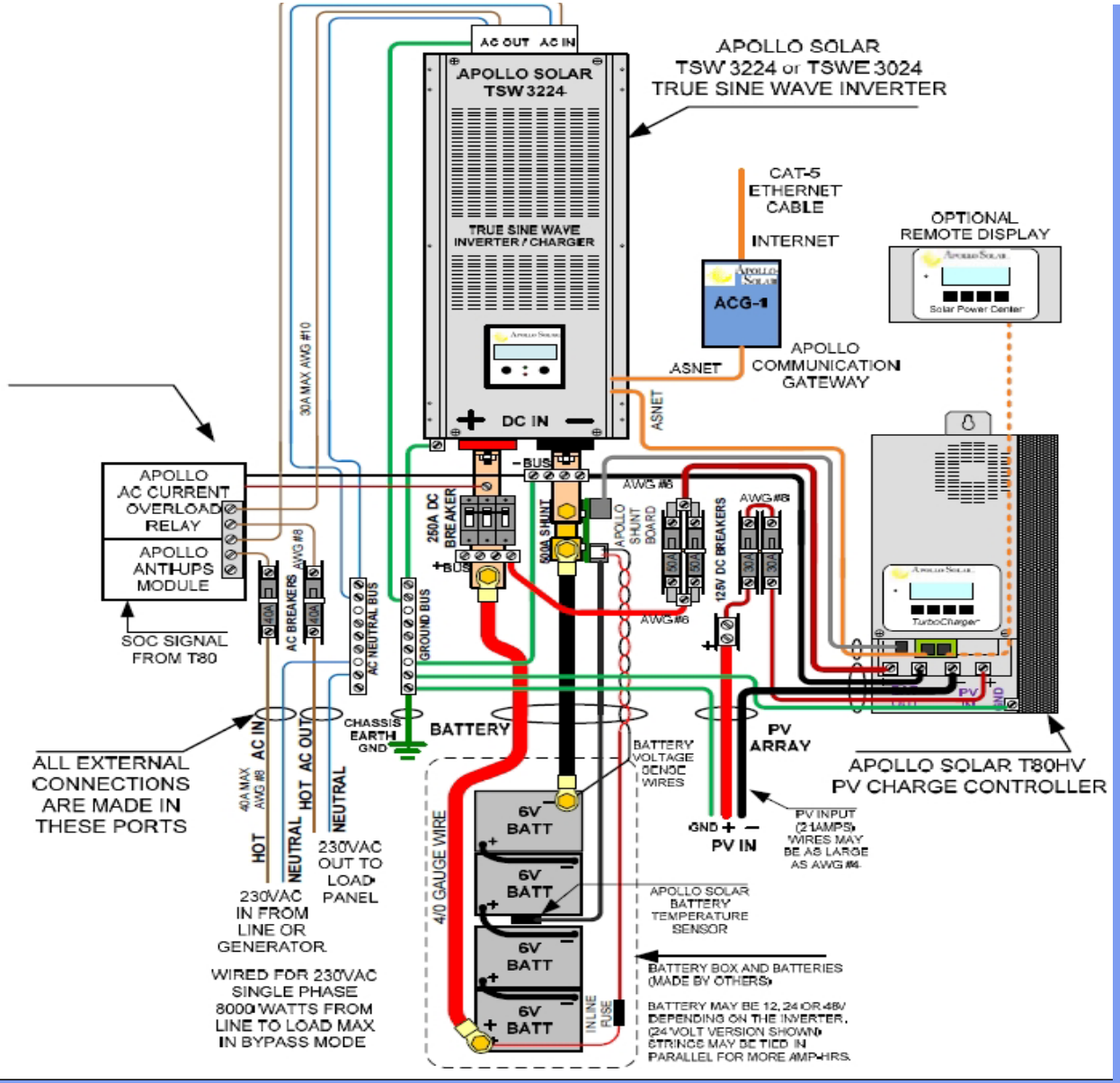
* Low cost
* Stackable with parallel inverters
* 120VAC single phase or
  240VAC Split Phase systems
* AC and DC DIN rail breakers
* Up to 250A main breaker
* Small size:
  11" wide, 15" tall, 7" deep
* Fully wired for turnkey installation.

Switchgear Module Wiring Diagram

The switchgear Module includes all DC and AC wiring.

The installer need only connect

1. External AC
2. PV input
3. Battery Cables.



Apollo Solar
Complete Stand-Alone BOS Electronics

* T80 and T80HV *TurboChargers*™

  80Amp MPPT Charge controllers with Built-in TriMetric Battery state-of-Charge meter

* Pure Sine wave Inverters - 2.0kVA to 3.6kVA

* Solar Power center and Switchgear module

* Remote monitoring via Internet --
  Checks performance of each system from any PC

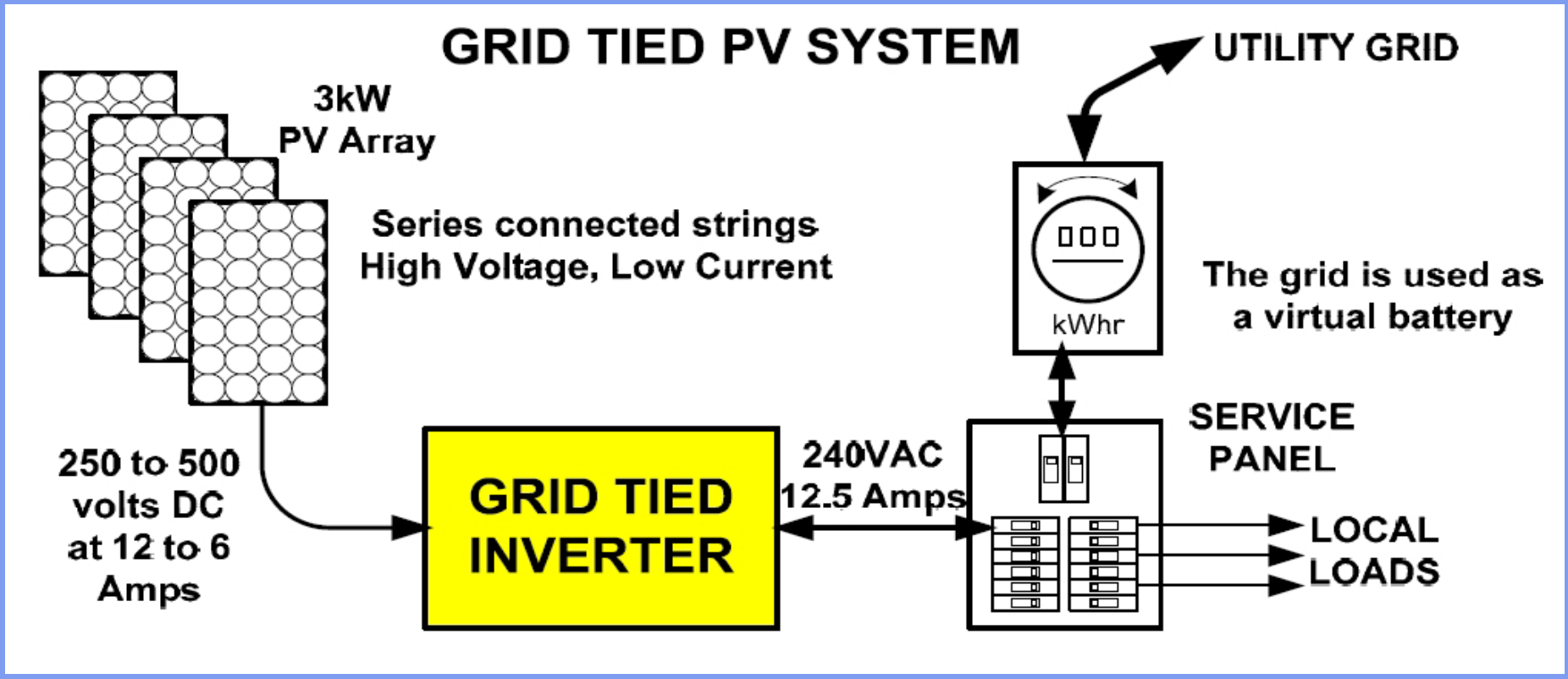
Your Source for Complete Stand-Alone BOS Electronics

Any Questions so far?

Now some details……

Grid-Tied PV is pretty simple

* The new Grid-tied Inverters include the AC and DC Disconnects and Ground Fault Protection.

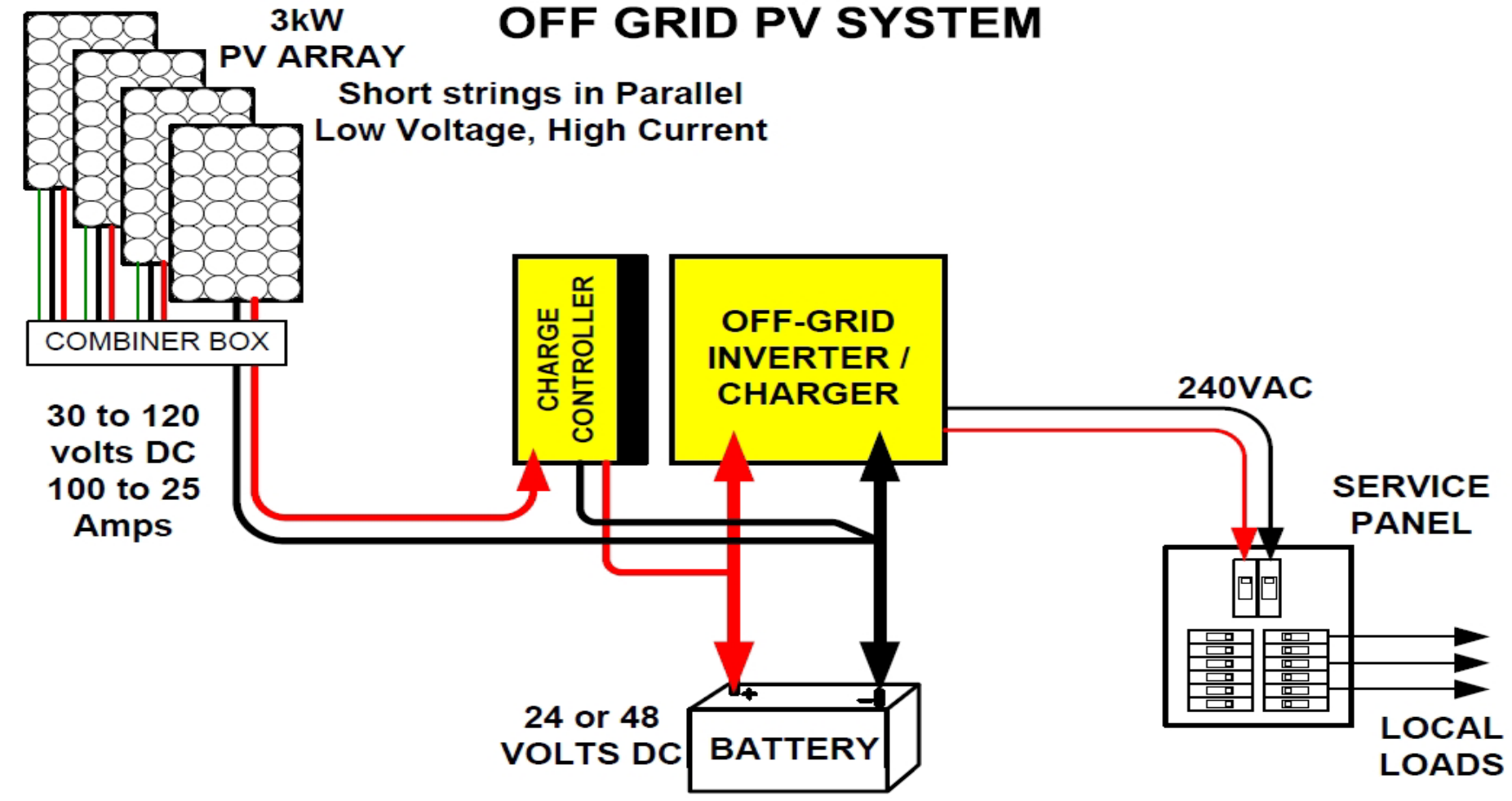


Stand-alone PV can take time

* The basic parts are easy:
    * PV array with Combiner box
    * Charge controller
    * Battery
    * Inverter
* The hard work is in the details:
    * Circuit Breakers and Disconnects
    * Battery Monitor, Shunt & Remote Display
    * Backup Generator, Bypass Switch & Gen Start
    * Then mount, wire, test, and enclose all parts….

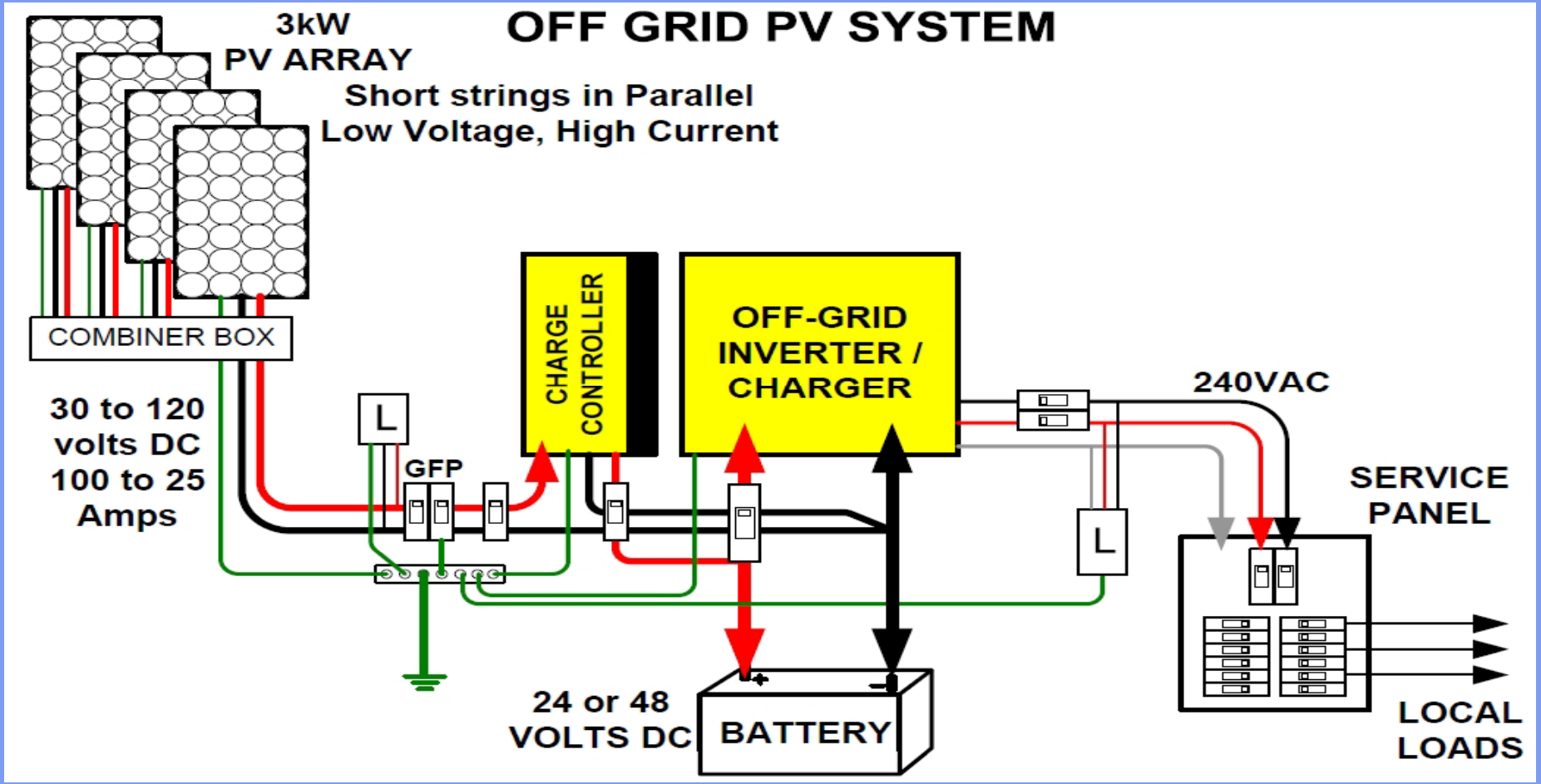
* ….. IIAN TECH does it all for you.

Typical Stand-Alone PV system - 1



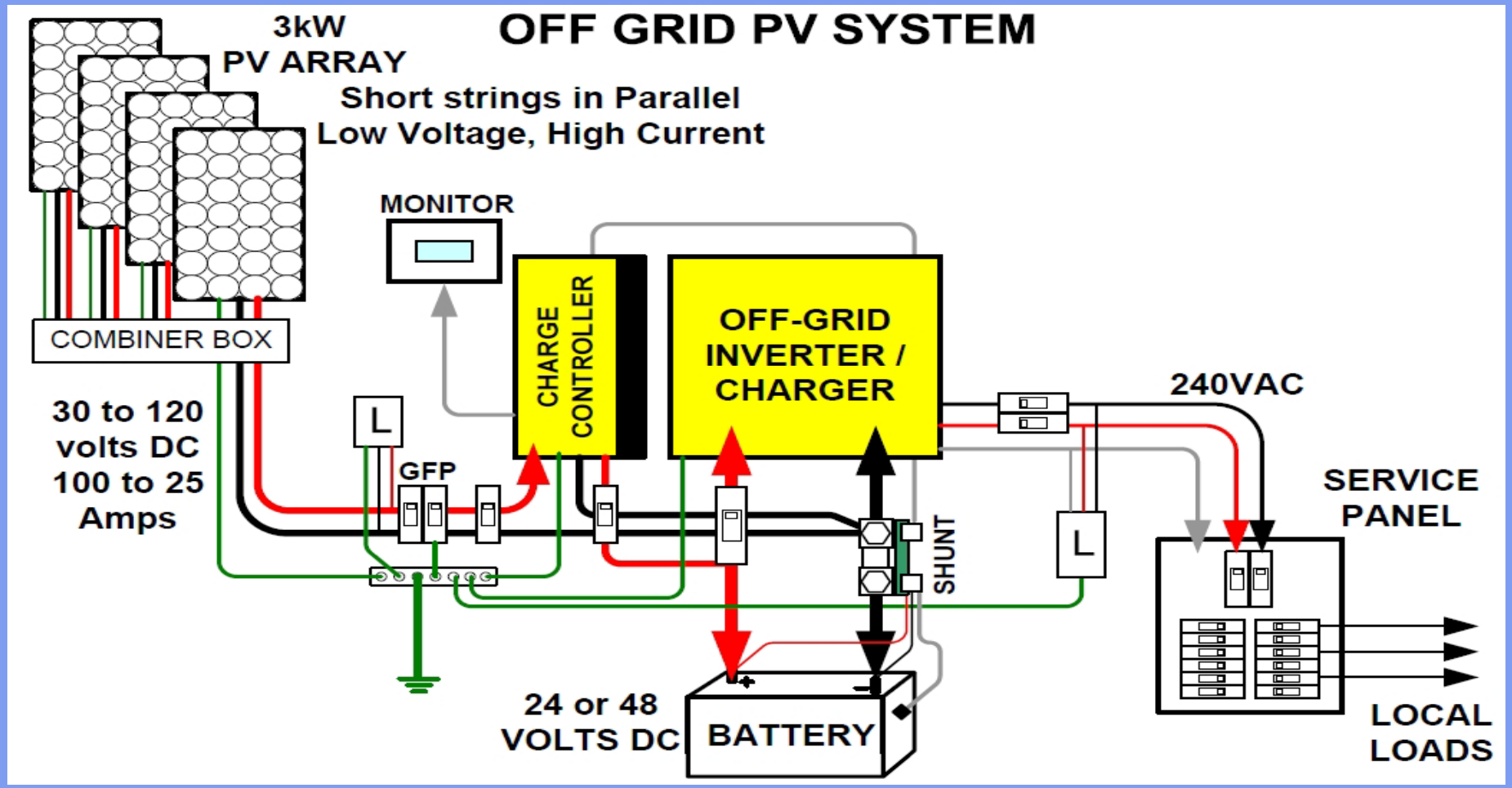
* Basically a Charge Controller, Battery & Inverter.

Typical Stand-Alone PV system - 2



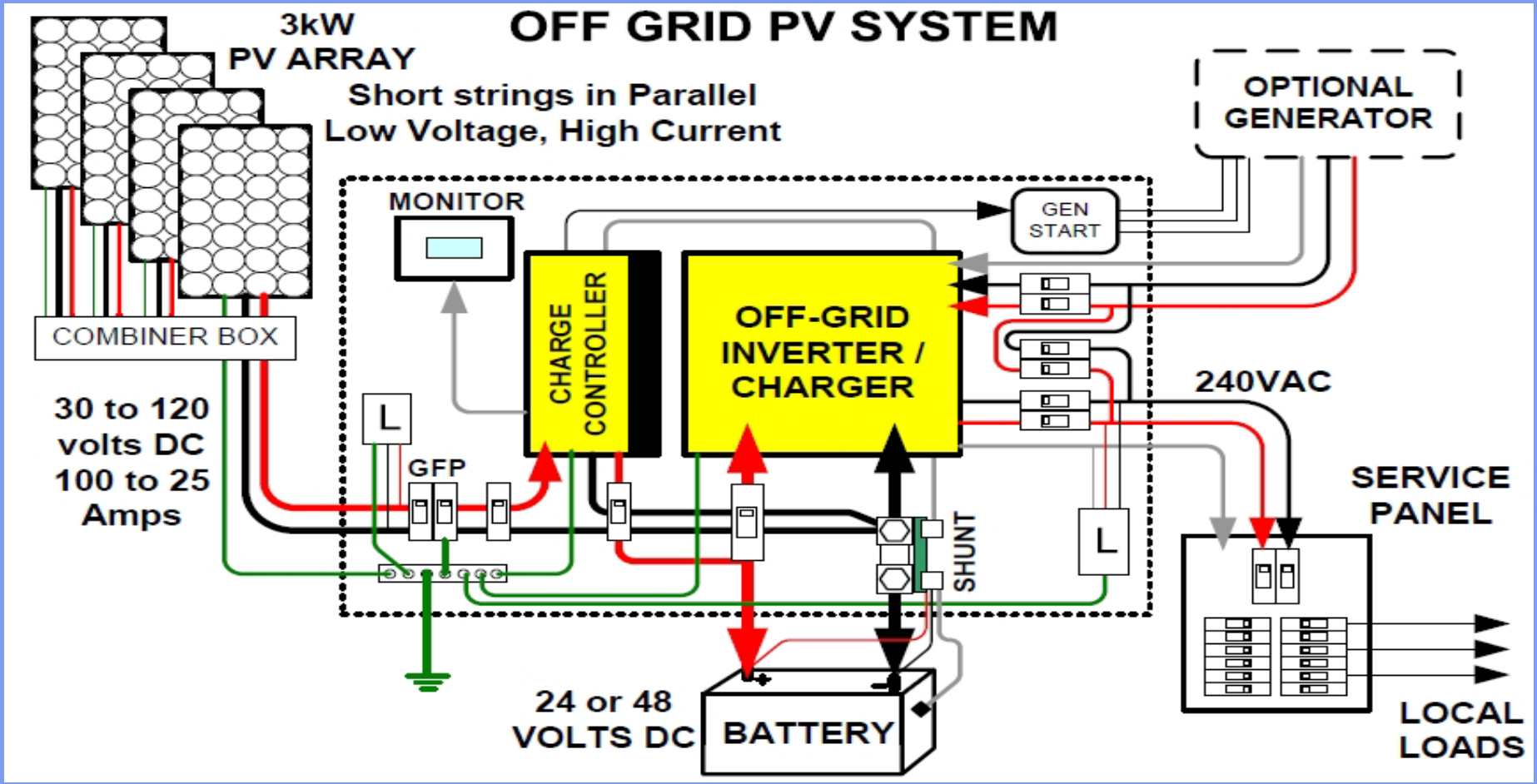
* Add Breakers, Lightning protection & GFP

Typical Stand-Alone PV system - 3



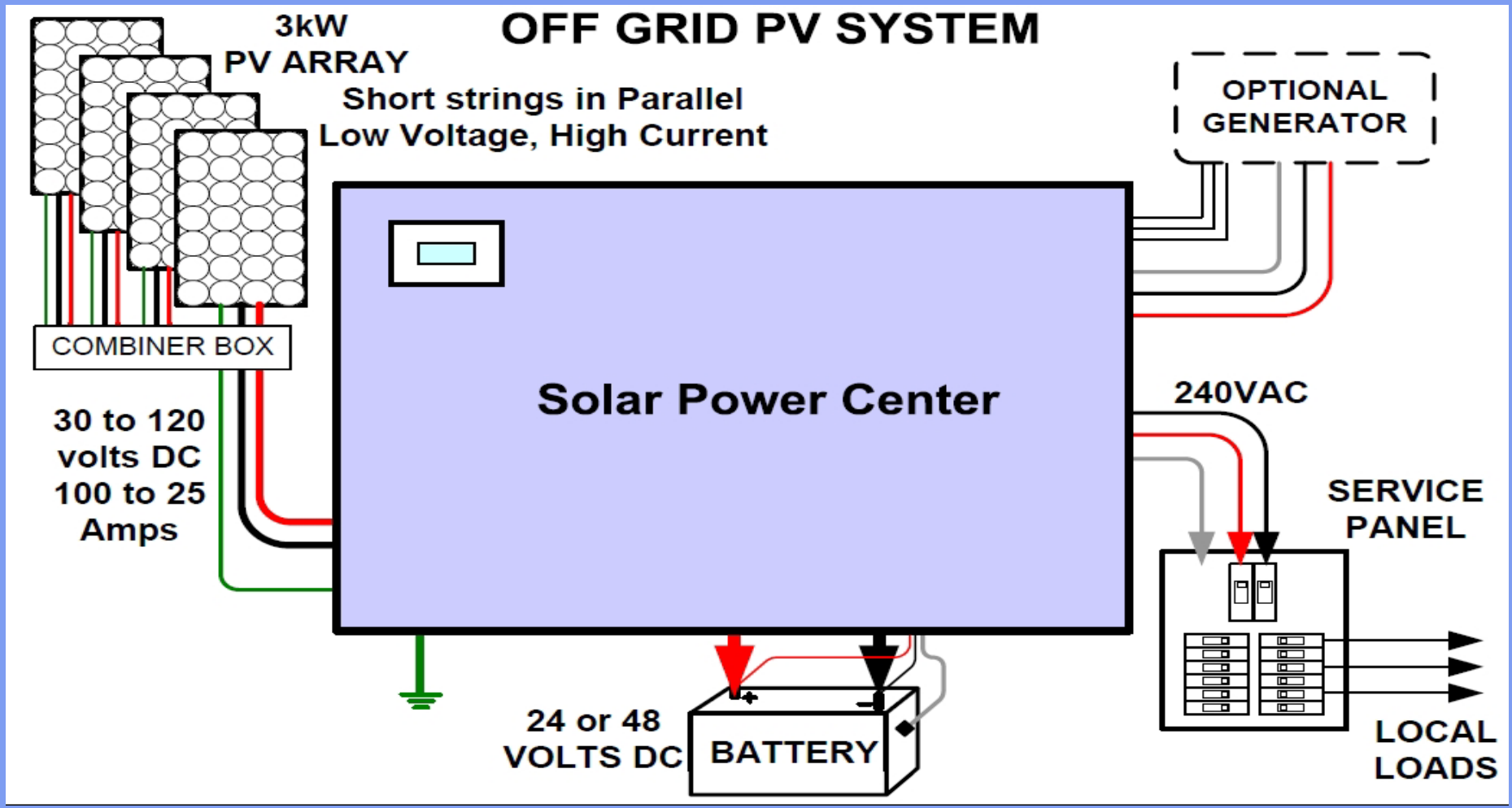
* Add Battery Monitor & Shunt

Typical Stand-Alone PV system - 4



* Many details are required in a real system

Apollo Stand-Alone PV system



* Apollo puts all the details in one enclosure

Solar Power Center

* Complete turn-key appliance-factory wired, ready for installation

* All components inside:

    * Pure Sine wave Inverter
    * Charge controller-Apollo Solar T80
    * Battery Energy Monitor & System Display
    * All Dc and AC breakers
    * Automatic switch to Grid or Generator when battery is low(Hybrid System)

* Temperproof enclosure

* option: IP66 sealed enclosure

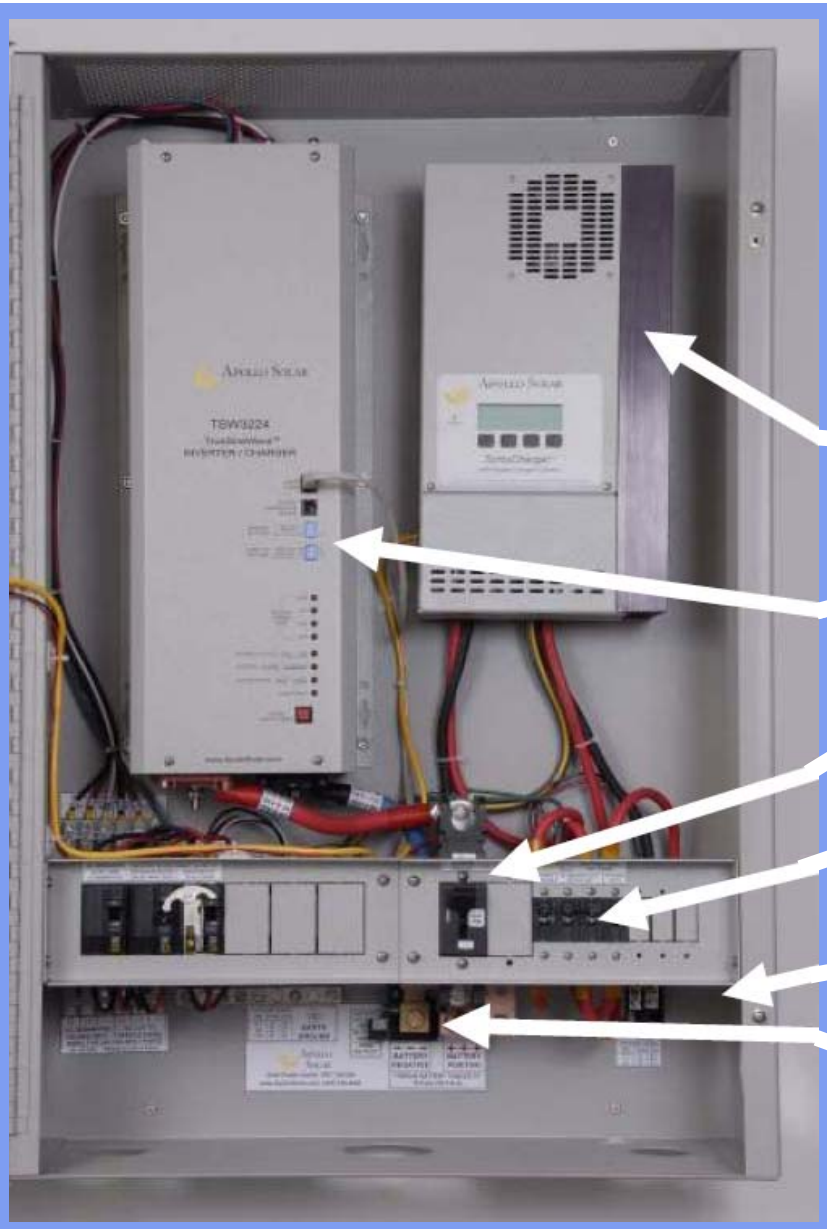
SPC 120/240 Solar power Center

240 VAC Breakers

AC-IN Bypass Inv-Out

DC Breakers

Inverter T80 GFP PV-In



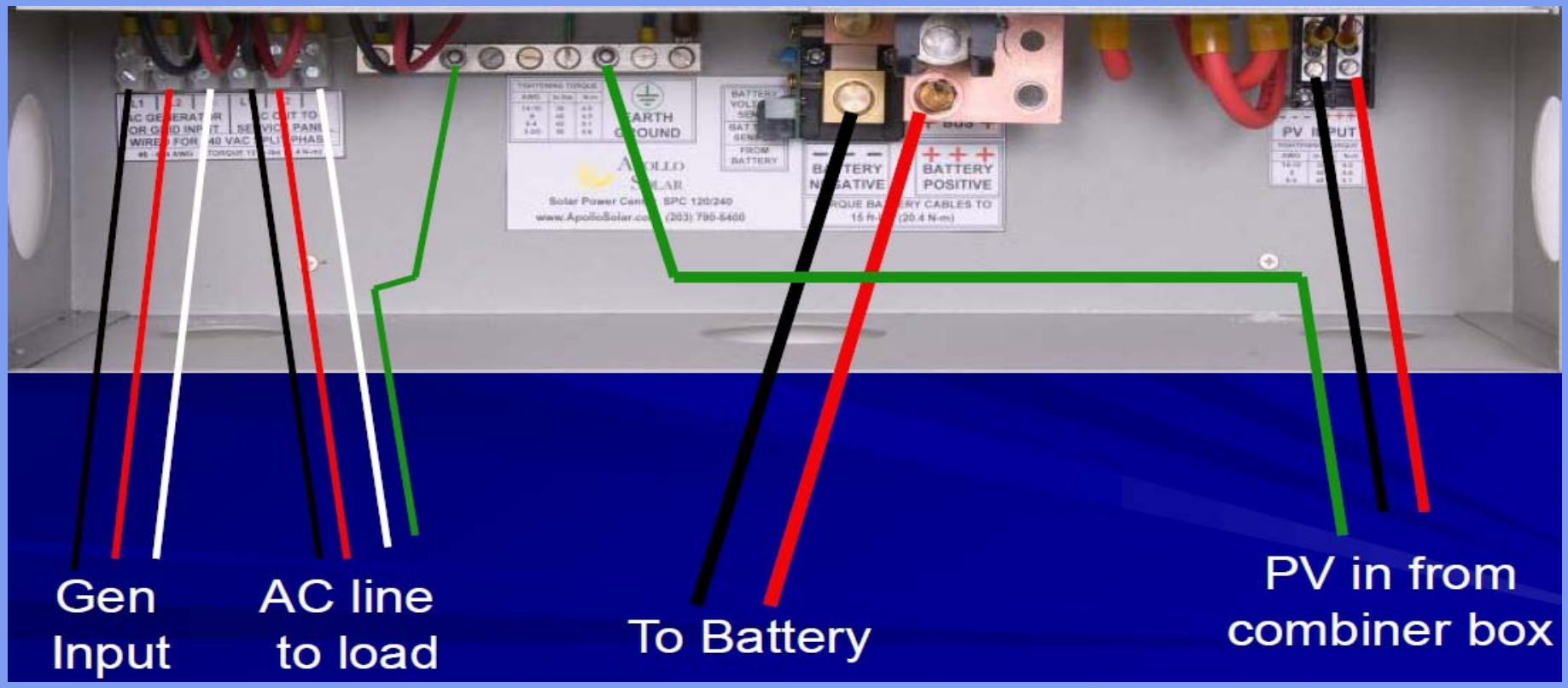
SPC 120/240 Solar power Center

All components of a stand-alone System in one enclosure:

* Charge Controller
* Inverter
* AC & DC Breakers
* GFP
* Lightning Arrestors
* Shunt
* System control/Monitor(on the door)

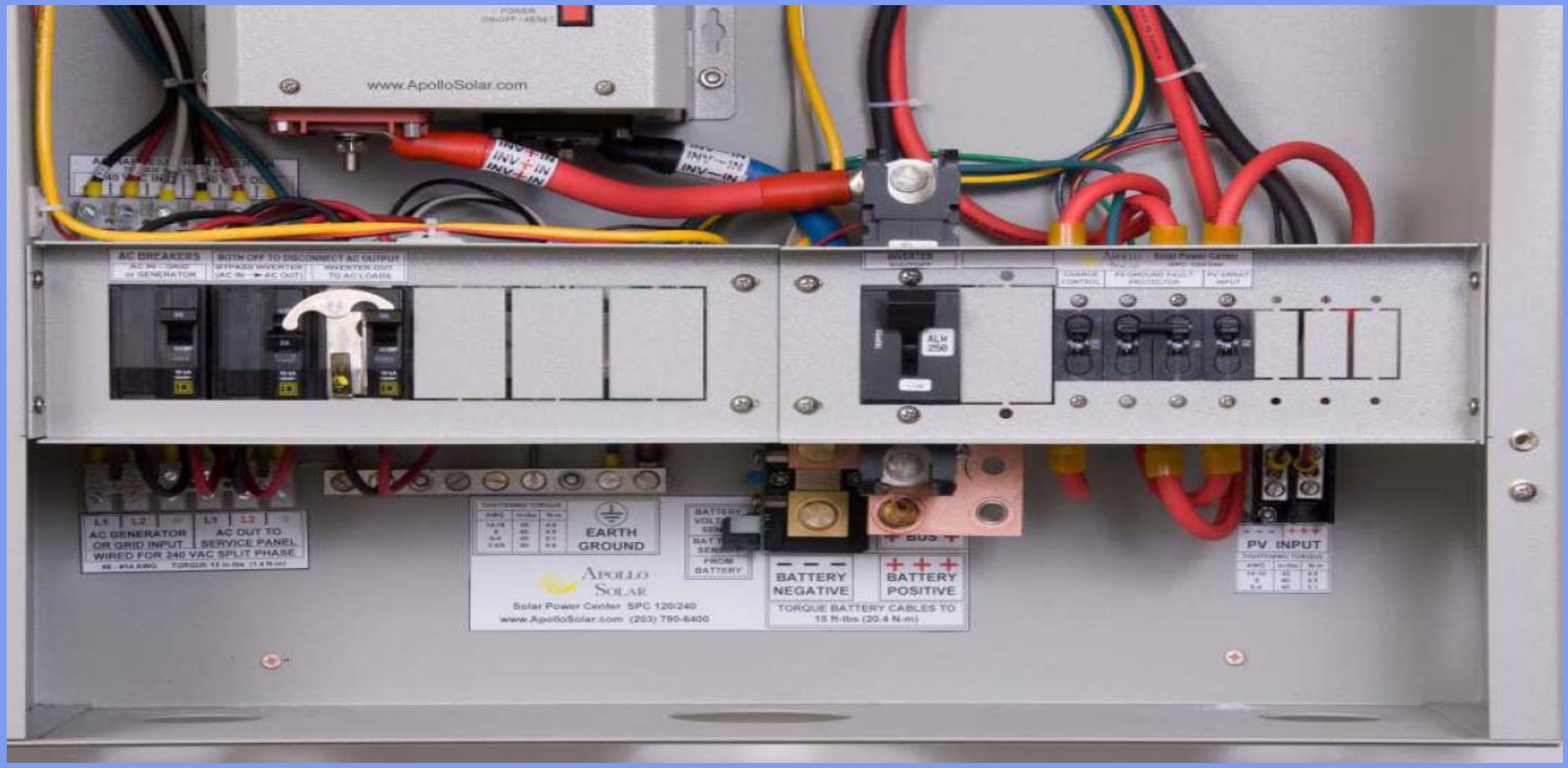
SPC 120/240 Solar Power Center

All external connections are made in the installer wiring area



SPC 120/240 Solar Power Center

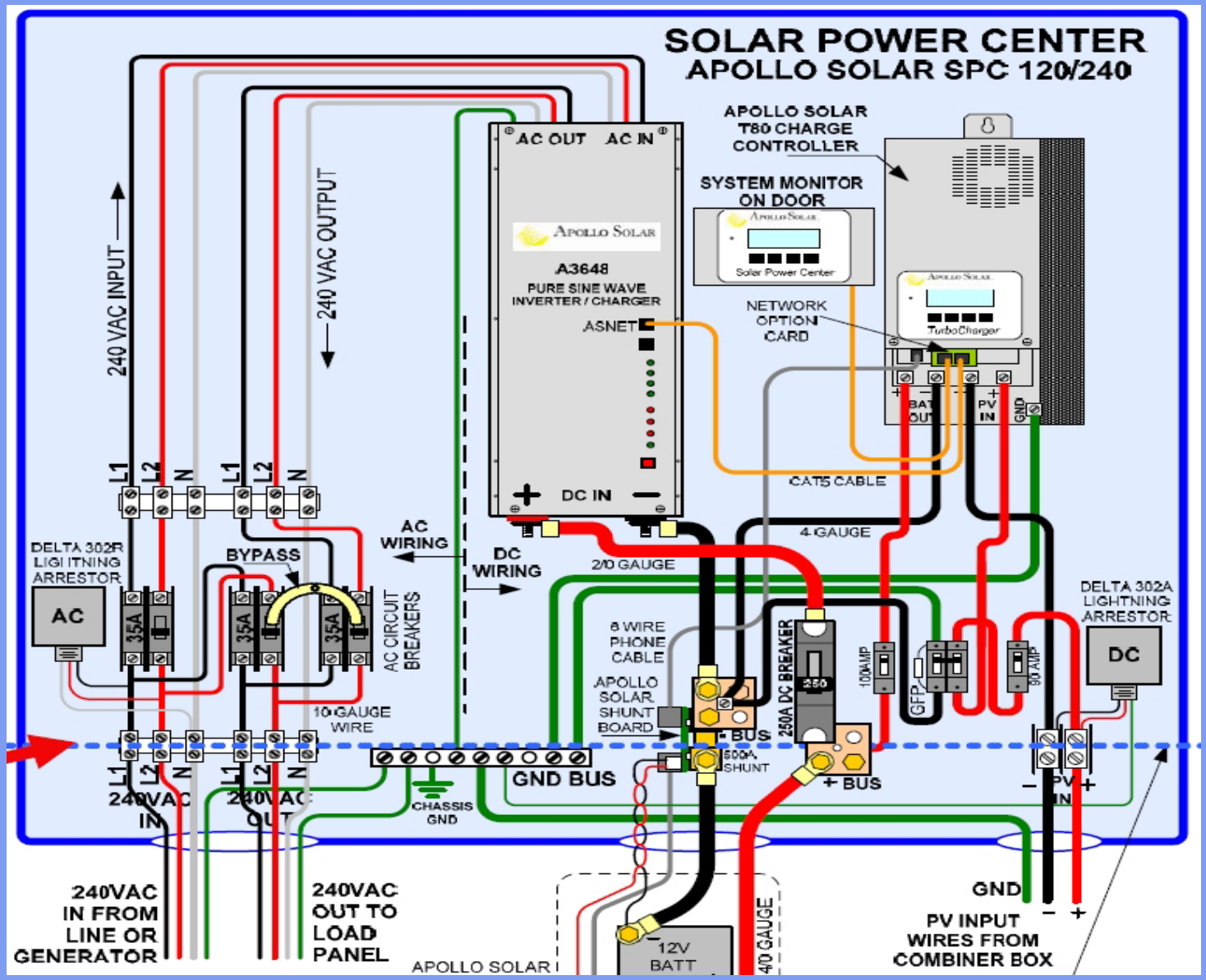
Installer wiring area and circuit breakers



SPC 120/240 Solar Power Center

Internal wiring diagram

All installer wiring is done below this line



Iian tech Co., Ltd

Iian Tech (Apollo Solar) has established technical superiority--

Here is how we do it -----

Apollo Solar Began with Work for NASA (the US Space Agency)

Apollo Solar designed and built a PV Battery Charger for NASA where reliability is mission critical.

NASA letter commending the work done by Apollo Solar

National Aeronautics and Space Administration
Langley Research Center
Hampton, VA 23681-0001

November 1, 2002

Reply to attn of: RFH

John Pfeiffer
Electronic Design Lab
23 F.J. Clarke Circle
Bethel, CT 06801

Dear Mr. Pfeiffer,

The GPSREX Team and I appreciate your contributions to the GPS Surface Reflection Experiment and the Radiation Experiment (GPSREX) package for the Nightglow Rollout Mission.

Your contributions in the development and fabrication of the Power Distribution Board and the Charge Controller Boards were critical for the successful completion of the GPSREX flight package.

You were adaptable, worked well as a team player, showed initiative, possessed excellent technical skills, demonstrated follow through, and were resourceful and creative in your work. Your attention to detail was both tireless and critical to the success of this mission.

It was a great pleasure to work with you and we are delighted to praise you on your commendable contribution to this project. Were it not for your dedicated efforts, we would not have reached this critical milestone at this time.

Cordially,

Richard A. Walker
NIGHTGLOW-GPSREX Project
NASA Langley Research Center

The Apollo Solar T80 *Turbocharger*™ is designed for tough duty

Apollo Solar Charge controllers are chosen where reliability is critical.

The only charge controller approved by the US Army for desert applications

Apollo Solar T80-- Only Charge Controller to Pass Rigorous US Army Testing

* U.S. Army D-REPS at Ft. Irwin, CA
Photo Courtesy Energy Masters

The Apollo T80 is an integral component in the USA Army Deployable renewable Energy power Stations,

D-REPS for short) to be deployed on military bases and forward action Missions throughout the world.

The Apollo T80 is the only system complete performance, environmental, and physical endurance testing.

The T80 - Best in class Charge Controller

* 80 Amps into batteries at up to 45℃(113°F) ambient temp.
* MPPT for best energy harvest
* Easy to install - full features
* Internal battery Energy Neter
* wireless remote Display option

Compare Features and Benefits-1

Apollo T80 and Outback FX80:

* T80: Full power at high anbient temoerature - 80Amps at 45℃
  Then ramps down 1 amp per 1℃
* Cost (list prices)
  $ 849 for the T80 with built-in battery monitor.
  $ 1,647 for the outback FX80 with battery monitor
* Faster, easier Installation - T80 -- Only 3 programming steps
* Optimum Energy harvest - Patent pending MPPT algorithm
* Better battery charger - 4 wire sensing for assurate battery voltage yields optimal battery charging and longer battery life
* Wireless and Internet Remote Monitoring : Available only from Apollo
* Warranty: T80 5 yearss Standard - FX80 2 Years Standard

Compare Features and Benefits-2

Apollo T80 and Xantrex XW60-150:

* Full power output at high ambient temperature - 80 Amps at 45℃
* Battery Energy Monitor included - no extra boxes to buy and
* Faster, easier Installation - Only 3 programming steps
* Optimum Energy harvest - Patent Pending MPPT algorithm
* Better battery charger - 4 wire sensing for accurate battery voltage yields full batteries and longer life.
* Wireless and Internet remote Monitoring : Available only from Apollo.
* warranty: T80 5 Years Standard - XW 2 Years Standard

Myth: Apollo T80 is too expensive

Fact: the T80 charge Controller includes the battery state of charge monitor and display.

It is really about 1/2 the price of the competition.

FUNCTION	OUTBACK PRODUCT	OUTBACK PRICE	APOLLO SOLAR PRODUCT	APOLLO PRICE
Charge Controller	FM80	$ 749	**T80**	$ 849
Battery Temperature Sensor	RTS	$ 29	**Included with T80**	
Battery Monitor	FN-DC	$ 379	**Included with T80**	
Connection Hub	HUB4	$ 195	**Not Required**	
Display	MATE	$ 295	**Included with T80**	$ -
		$ 1,647		**$ 849**

WOW, Apollo gives us better performance for about 1/2 the price!!!!!
And this does not count the extra labor time to install, connect and debug the extra parts.

Apollo offers the only Wireless Remote Display in addition to a wired version. You can add one and still have money left over.

Telecom Companies select Apollo for Fail-Safe OFF-Grid PV Electronics

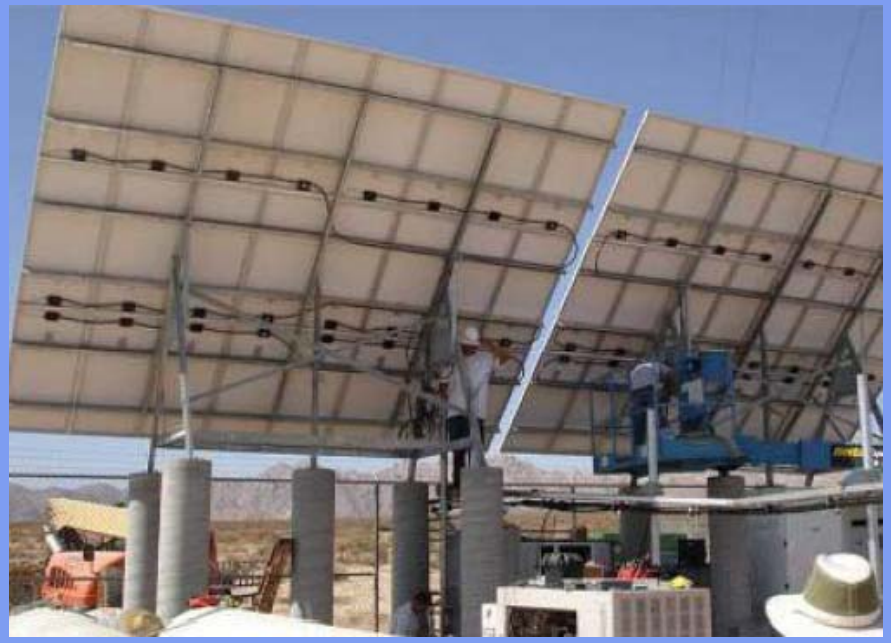
Apollo Solar Balance-ofSystem Electronics are specified for telecom installations because:

* Proven Reliability
* designed for difficult environments - Jungle, Islands, etc.
* Superior Technology - Best MPPT, Remote Monitoring
* Cost effective - Lowers costs of installation & maintenance
* complete turn-key systems from one manufacturer
* Great technical and sales support - One call: One solution
* Long warranty - 5 years on complete systems

Apollo Remote Telecom sites

13.8Kw system using 4 Apollo Solar T80s to power a cell site in the canadian mountains.

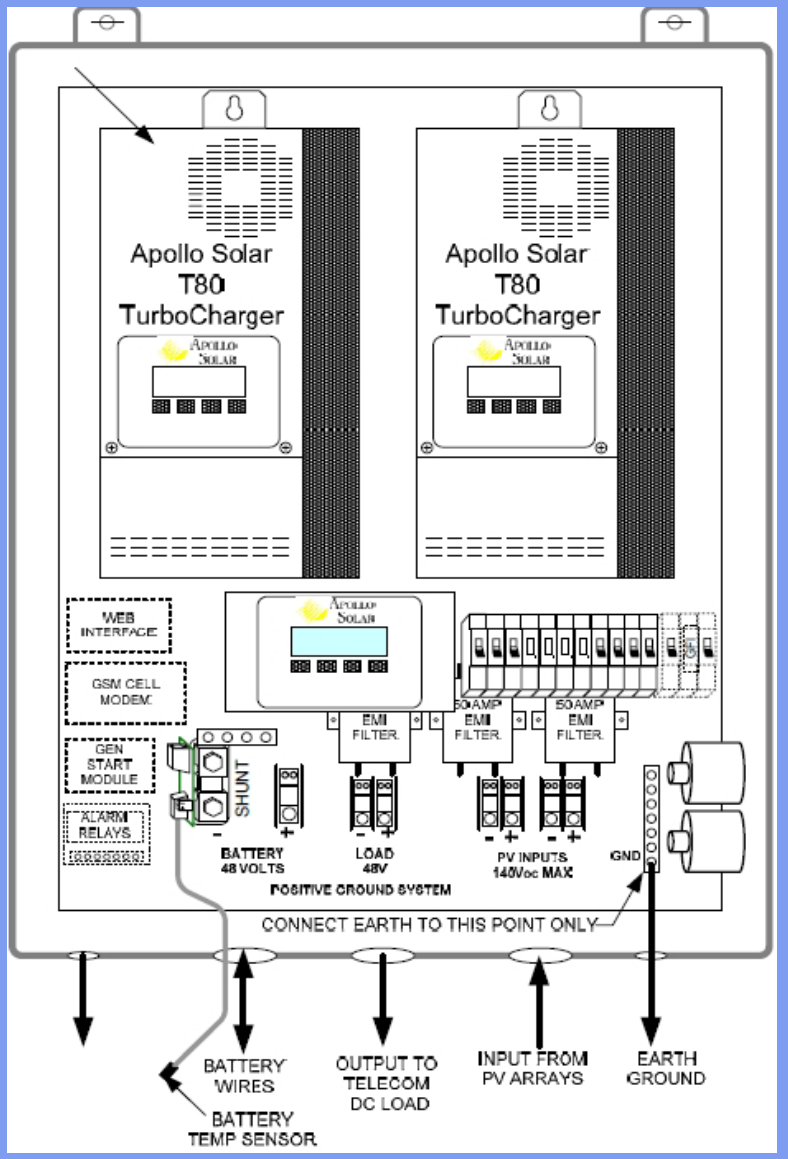
Apollo Remote Telecom Sites



Telecom site using 3 Apollo Solar T80s in the desert region of southwestern California in the United States.

Photo courtesy SunWize technologies. Www.sunwize.com

Complete Telecom PV Battery Charge Management System in One Enclosure



* Designed for optimum reliability in tough environments.
* IP66 enclosure keeps bugs, sand, water and corrosion out

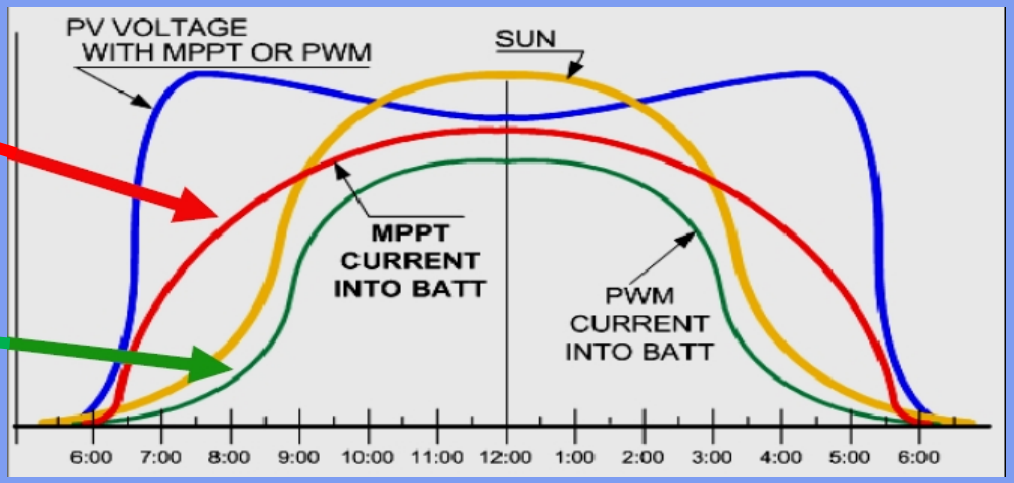
Apollo Solar Has Established Technical Superiority

* Best Energy Harvest using patented MPPT
  (Fewer PV modules for the same output)
* Lower internal temperature for longer life
* Integrated Battery State-of-Charge meter
* Isolated data port for positive ground systems
* Automatic current reduction and continued operation rather than shunt-down at temperatures above 45℃

MPPT vs PWM Energy harvest

* MPPT is based on a DC to DC Converter which converts all the PV voltage into useful current into the battery.
* Our MPPT algorithm finds and tracks the peak product of PV voltage and current as it changes with temoerature and light.
* PWM based charges do not have DC to DC converters so must throw away any power when above the battery voltage.

MPPT Current (in **red**) is greater all day than the PWM current (in **green**).



Energy Monitor is Built-In

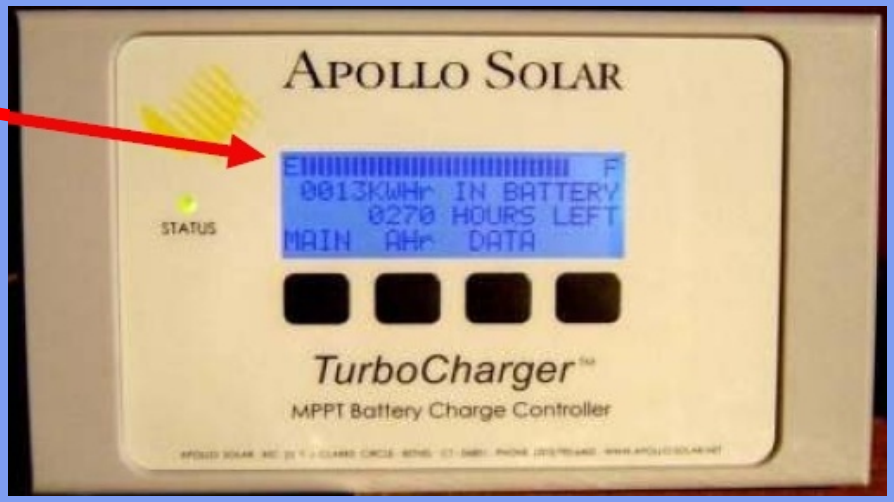
* Essential battery Energy Meter for all Stand-Alone / Off- Grid systems

* Complete Display of PV system performance

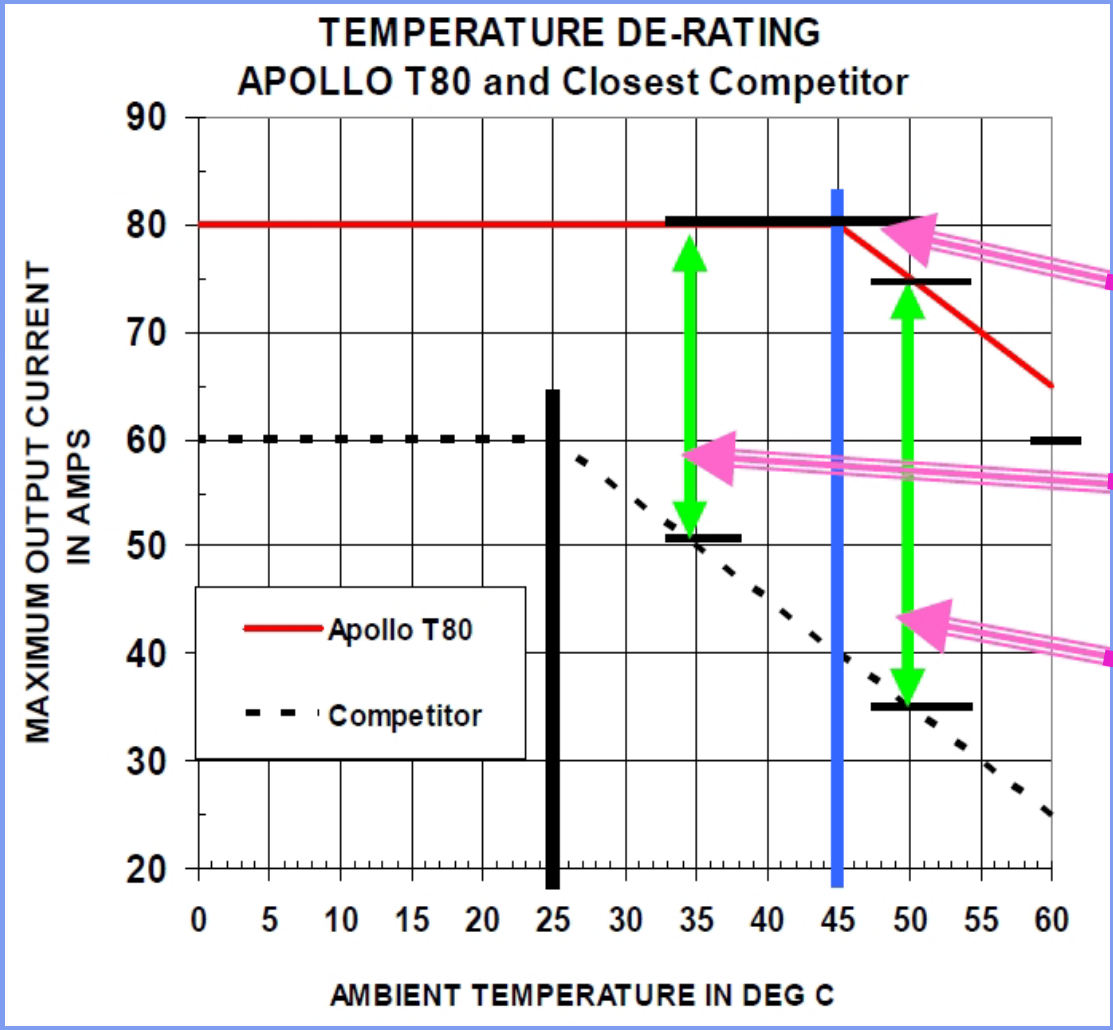
    * The only accurate method to measure the battery State of Charge
    * read the PV Array voltage and current
    * Check the load current and the hours left in the battery
    * See instantaneous status and 90 day history

* Easy to read " Gas Gauge " Bar Graph of battery energy showing SOC (State-of-charge)

* Exclusive Wireless (or Wired) Remote display of All Data.



Full Power rating to 45℃ (113˚F)



Apollo Solar T80
can take the heat

* T80 is 80Amps at 45℃ (113˚F)

* 60% more current at 35℃ (95˚F)

* >Twice the current at 50℃ (112˚F)

* Disclaimer: The de-rating of the competitor's unit above 25℃ is their own estimate of 1℃/Amp.

Complete Stacking Features

* Stack up to 16 T80s in parallel for 1280 Amps

* Easy nwtwork Option Card & CAT5 daisy chain-
  No external hubs required

* Program all parallel *TurboChargers*™ from one master

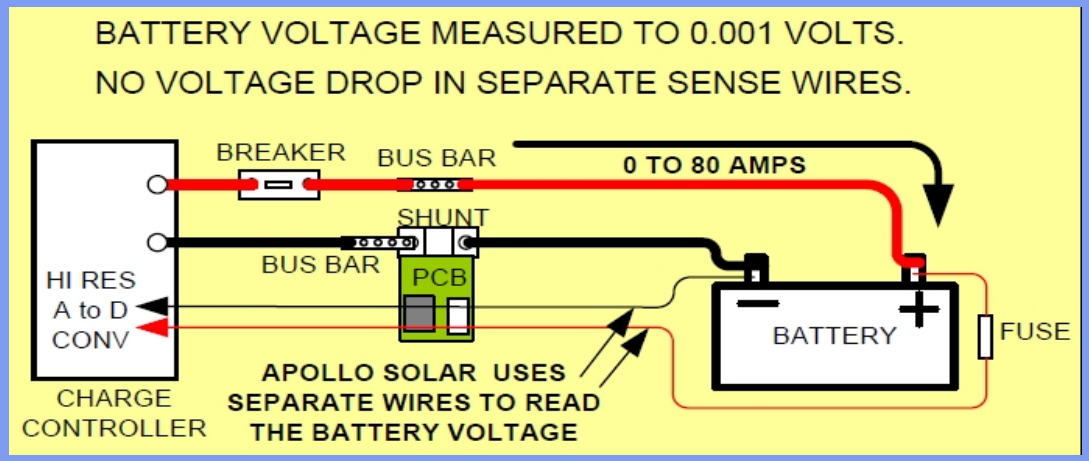
* All *TurboChargers*™ work as one unit with many MPPT inputs

* Complete energy harvest reporting from all units

Precision Charging for Longer Battery Life

* Direct "4-wire" reading of battery terminal voltage
  - No errors from unknown cable and connector resistances.
  - No current in sense wires.

* high resolution A to D converter on critical inputs
  - Accurate battery set points that stay where tou set them.

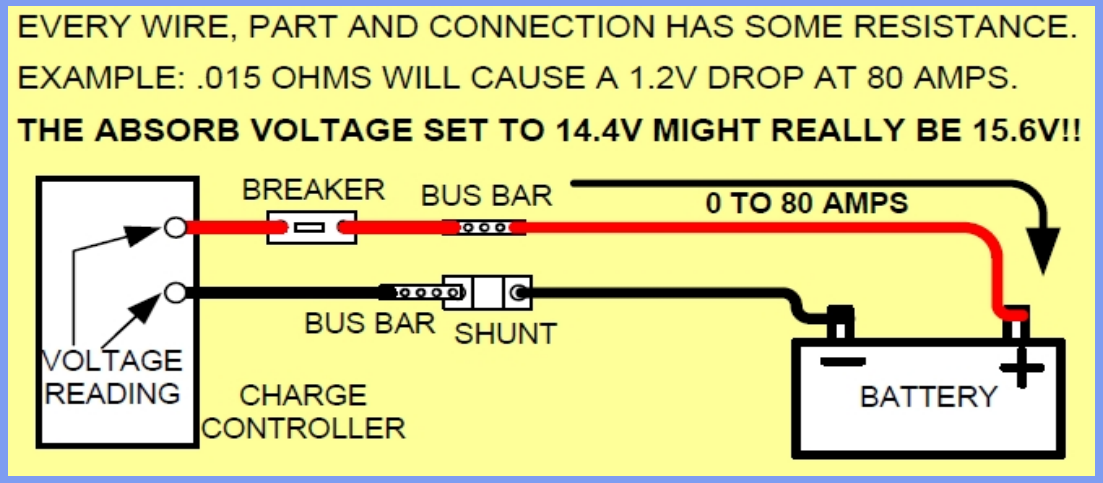


Apollo TurboChargers with 4-wire sensing

Other products -->

Without 4-wire sensing.

Actual battery voltage can be very different from your settings.



Setting up the T80 - Just 3 Steps
" As easy as A-B-C"

* Step A - T80 reads your battery voltage.

* Step B - Enter battery type & size.
  T80 sets the charging parameters.
  Tweak them if you like.

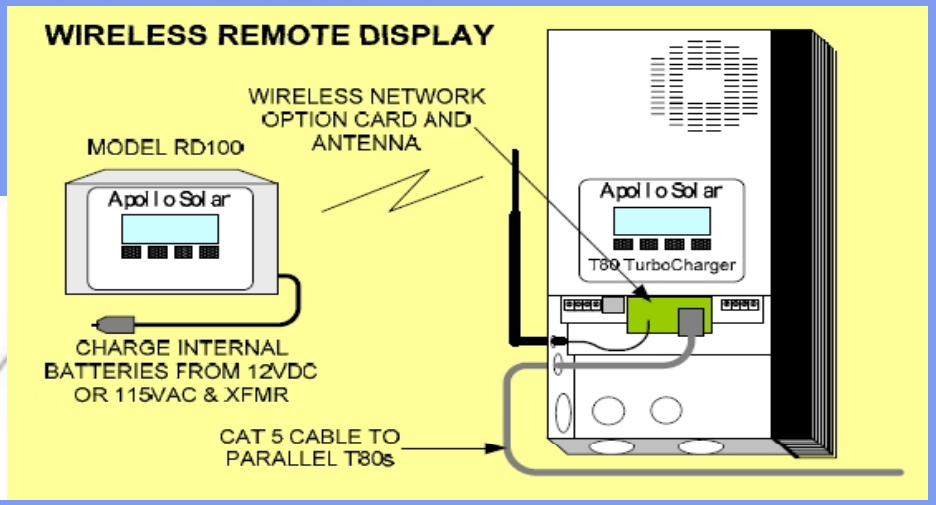
* Step C - set Time & date, and Go.

  (When a Remote Display is connected, it automatically sets the date and time from its internal real-time clock.)

Remote Displays

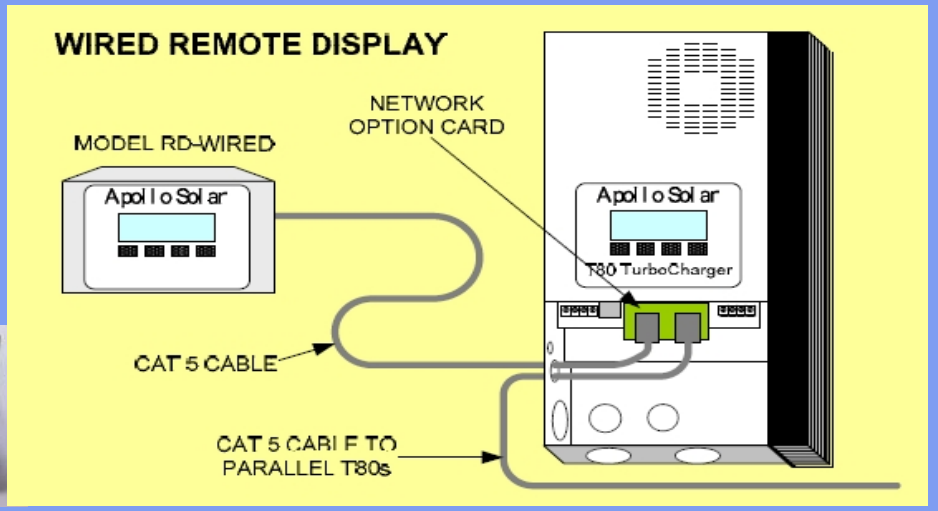
Wireless Remote Display

* RF Network Option Card
* Internal Battery in Display
* Range inside and outside


WIRELESS REMOTE DISPLAY
WIRELESS NETWORK OPTION CARD AND ANTENNA
MODEL RD100
Apollo Solar
CHARGE INTERNAL BATTERIES FROM 12VDC OR 115VAC & XFMR
CAT 5 CABLE TO PARALLEL T80s
Apollo Solar
T80 TurboCharger

Wired rempte Display

* Standard Network card
* Power from the T80
* CAT 5 cable



System Enclosure Choices

1) Solar Power Center

- Totally Enclosed
- Secure

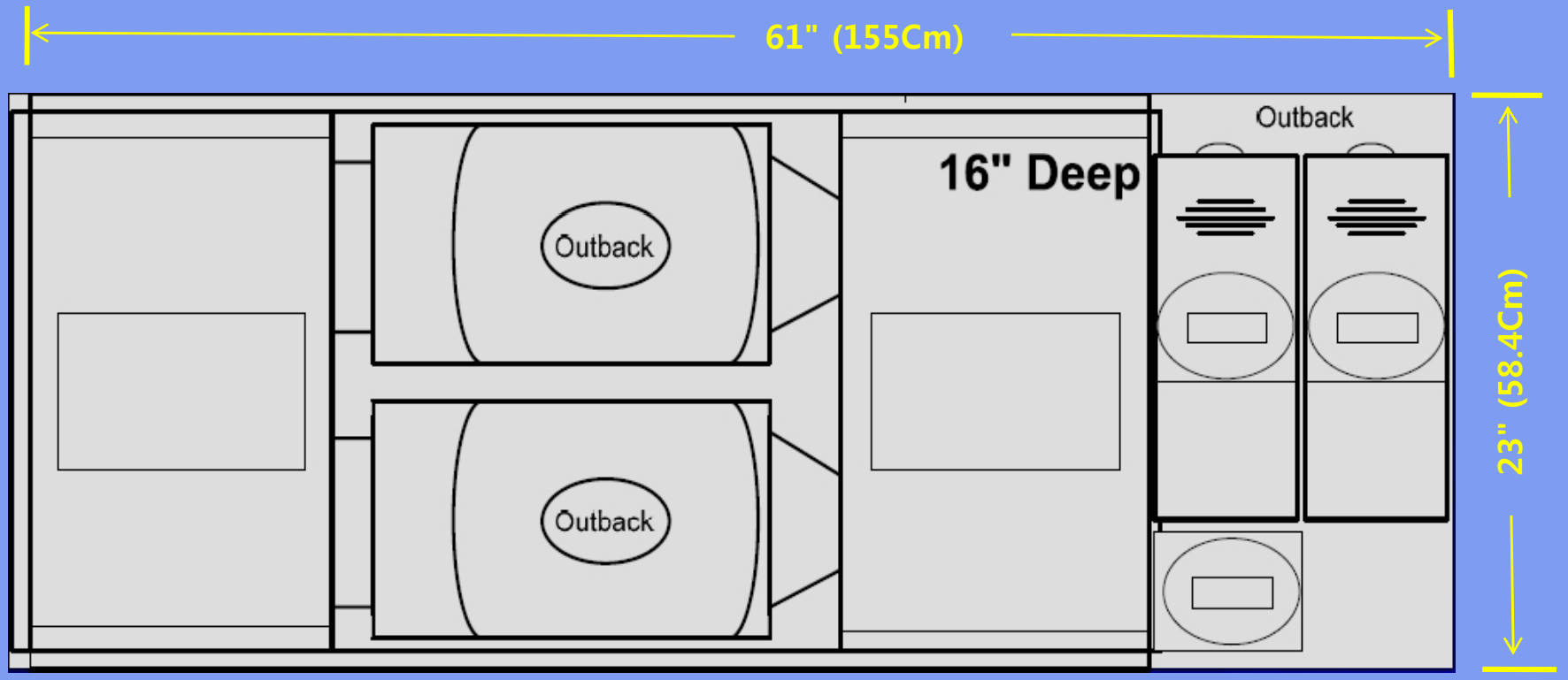
2) Switchgear Module

- Upgradable for more power
- Lowest cost

Both are complete Turn-key appliances - factory wired and ready for installation.

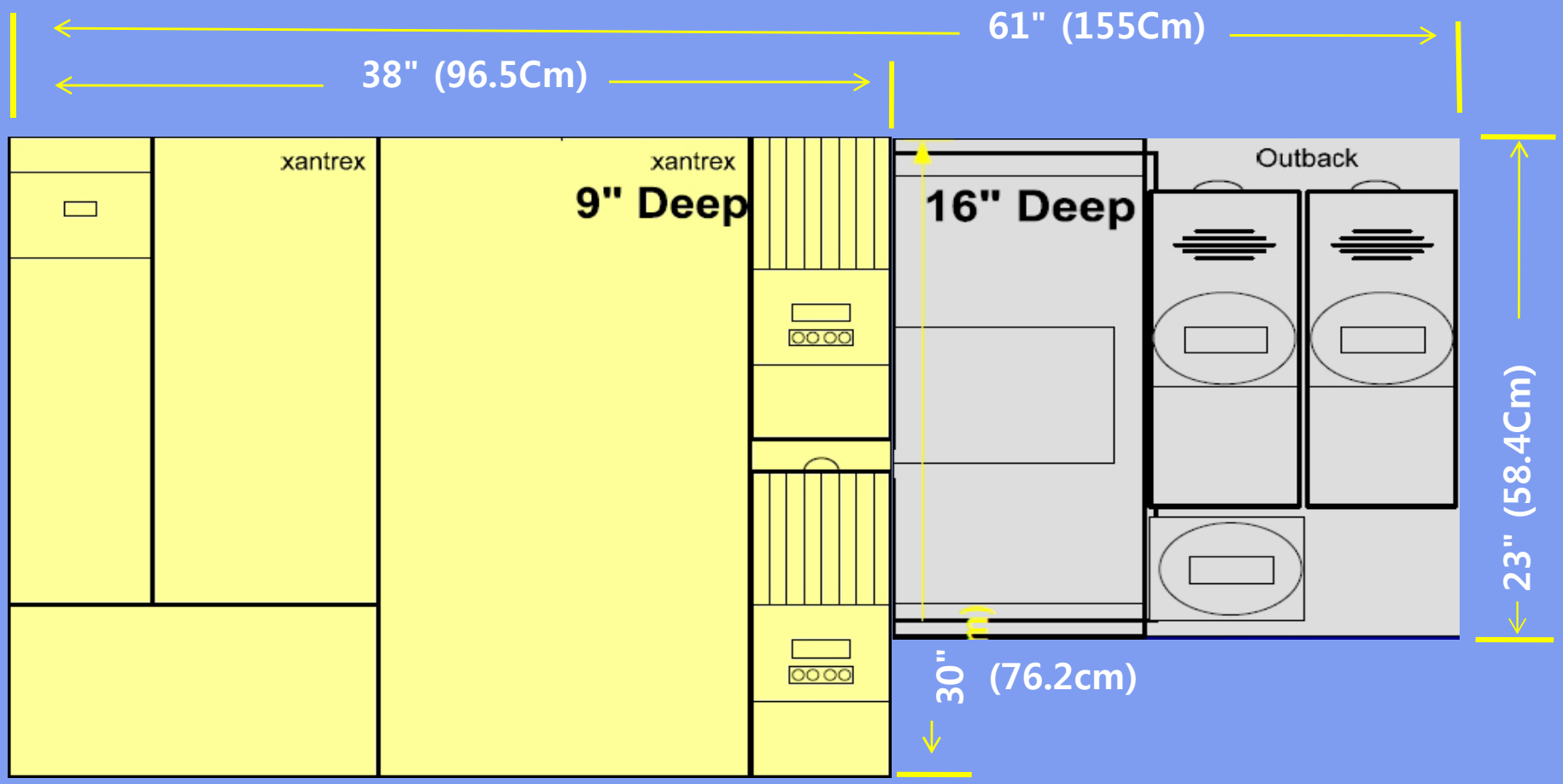
Inverter Switchgear Module shown with TSW Inverter

Available Power Panels-1



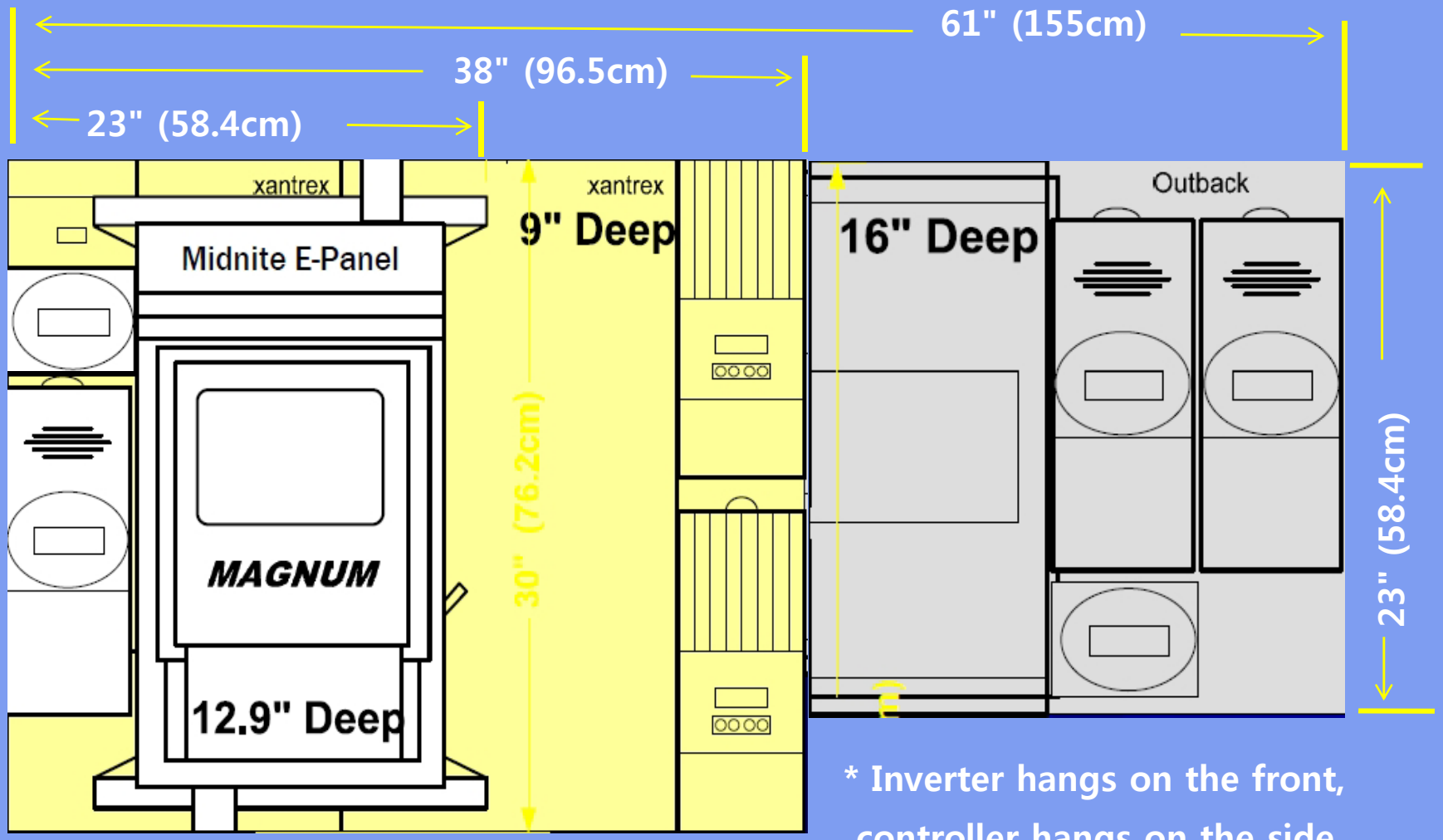
* Very large, need 2 Inverters for 120/240 VDC

Available Power Panels-2



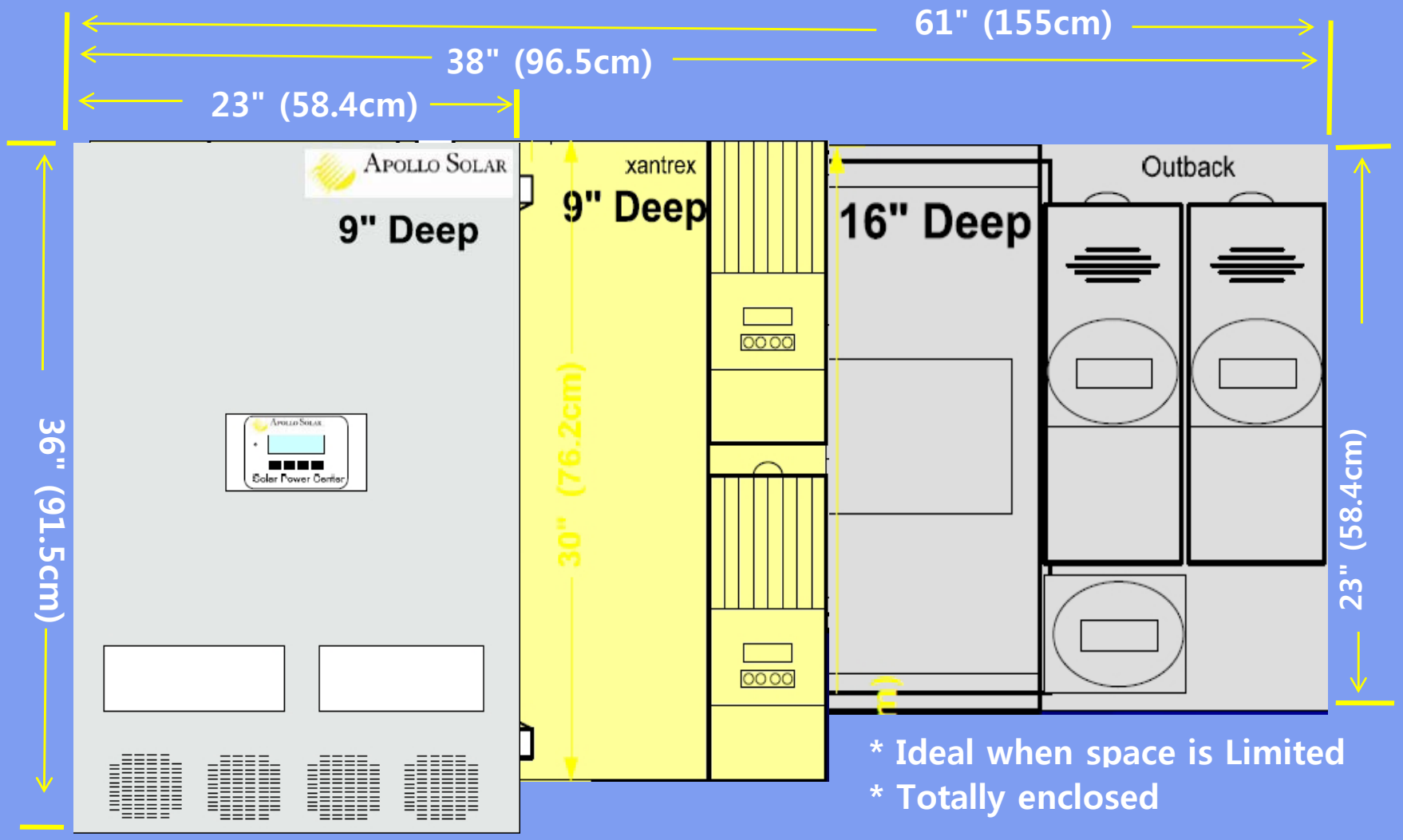
* Smaller, still ships on a pallet

Available Power Panels-3



* Inverter hangs on the front, controller hangs on the side

Apollo Solar Power panel (SPC)



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